

UNDERWATER ARCHAEOLOGICAL INVESTIGATIONS  
SHIP ISLAND PASS  
GULFPORT HARBOR, MISSISSIPPI

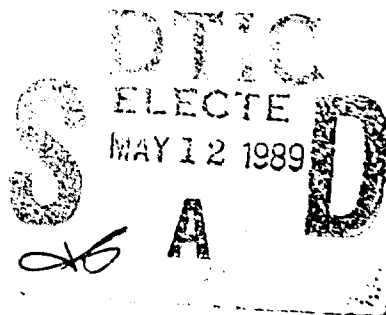
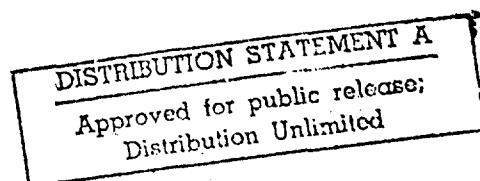
JACK B. IRION, M.A.  
PRINCIPAL INVESTIGATOR

Submitted to the  
U.S. Army Corps of Engineers,  
Mobile District

under the provisions of  
Contract No. DACW01-89-C-0006

GAI Consultants, Inc.  
570 Beatty Road  
Monroeville, Pennsylvania 15146

April 1989



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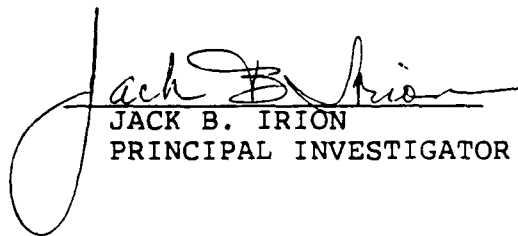
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Report No. COESAM/PDER-89/002

U.S. ARMY ENGINEER DISTRICT, MOBILE  
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UNDERWATER ARCHAEOLOGICAL INVESTIGATIONS  
SHIP ISLAND PASS, GULFPORT HARBOR, MISSISSIPPI  
CONTRACT NUMBER DACW01-89-C-0006



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PROJECT 88-354-10

APRIL 1989

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## ABSTRACT

An archaeological Phase II assessment of five magnetic anomalies has been completed as part of a planned deepening and widening of the Gulfport Harbor channel by the U.S. Army Corps of Engineers, Mobile District. A documentary research program was also implemented in various federal archives in order to expand the list of potential shipwreck sites in the Gulfport area. This document presents the results of the remote sensing and diving investigation of the five anomalies and a compilation of information on eight additional shipwreck sites in the Gulfport area. Neither the documentary research nor the physical examination of magnetic targets yielded evidence of significant historic or prehistoric cultural resources in the project area. No further work is recommended.

## PROJECT BACKGROUND

The Mobile District, United States Army Corps of Engineers is considering improvements to the existing Federally authorized Gulfport Harbor, Mississippi navigation channel. The improvements include deepening and widening the existing channel for a distance of approximately 20 miles and realignment of the existing channel through Ship Island Pass.

Documentary research was conducted in 1987 as part of the studies undertaken to insure that significant historic properties will not be affected by this action. This study, entitled "Documentary Research, Submerged Cultural Resources in the Vicinity of Gulfport, Mississippi" failed to locate any historically significant shipwrecks with an exact location within Gulfport Channel (Mistovich 1987:27). The report recommended, however, that a remote sensing survey be conducted between beacons 37 and 13, which is the area of the proposed new channel dredging for the preferred realignment around the west end of Ship Island.

In October 1986, September 1987, February/March 1988, and April 1988 a number of potential channel realignments were surveyed for cultural resources by personnel from the Mobile District, U.S. Army Corps of Engineers (Mobile District 1988a). The remote sensing equipment array consisted of a magnetometer, a side scan sonar and a depth sounder. Real time positioning was maintained using radio-positioning equipment. As a result of this survey, five

anomalies were recommended for Phase II evaluation in the selected alignment.

GAI Consultants, Inc. (GAI) was contracted to provide an underwater archaeological evaluation of the five anomalies for potential eligibility to the National Register of Historic Places. Fieldwork took place between November 7 and November 21, 1988. The field crew consisted of the Principal Investigator and five underwater archaeologists, all of whom are certified divers. The fieldwork utilized both SCUBA and surface-supplied underwater breathing equipment. The diving platform consisted of a 42-foot aluminum-hulled crewboat driven by twin Detroit diesel engines.

The most limiting factor to the field work proved to be seasonal south winds which blew in excess of 20 knots on certain days during the project. The southerly winds built up six to eight foot rollers in the exposed project area, rendering diving impossible during this time.

The underwater archaeological investigation of Ship Island Pass represents a comprehensive testing program in accordance with the Mobile District's responsibilities for cultural resources under the National Historic Preservation Act of 1966 (PL 89-655) as amended, the National Environmental Policy Act of 1966 (PL 91-190), Executive Order 11593, and the Archaeological and Historical Preservation Act of 1974 (PL 93-2911).

## GEOGRAPHICAL AND ENVIRONMENTAL SETTING

The project area lies in Ship Island Pass, west of the west point of Ship Island, 12.5 miles southeast of Gulfport, Mississippi in the Gulf of Mexico. Anomalies BB-1-1 and C-1-6 are located approximately 3,000 feet (0.9 Km) west of the west point of Ship Island. Anomalies A-3-7, A-2-8 and A-1-1 are clustered in an area between 6,000 and 6,500 feet south of the west point of Ship Island (Figure 1).

Gulfport and the Mississippi Sound are located in the Gulf Coastal Plain Physiographic Province and are underlain by consolidated and unconsolidated sediments that range in age from Miocene to Holocene. The Pliocene age Citronelle Formation overlies the Miocene deposits. The Citronelle Formation consists of red to reddish orange and yellow gravelly sand and ranges up to 200 feet thick in the vicinity of Ship Island. Semi-consolidated to unconsolidated sediments of Pleistocene and Holocene age overlay the Citronelle Formation in the Mississippi Sound. A Pleistocene age soft gray plastic clay several tens of feet thick forms the upper layer sediments in the Gulfport Channel beyond Ship Island in the Gulf of Mexico. One to one and one-half feet of gray brown sand overlays the Pleistocene clay layer in the project area (Mobile District 1988b).

Nearby Ship Island is one of several off-shore bars formed by shore-wise currents in the Gulf (Figure 2). Dunes on Ship Island can peak as high as 20 feet above sea

level. The dunes vary from small haystack dunes to wandering barren dunes. They are composed of glistening fine to medium white sand with a negligible quantity of organic matter. Throughout the dune area many blowouts occur, and the island's topography is constantly changing (Brown et al. 1944). The steady westward migration of Ship Island has necessitated the proposed dredging project (Figure 3).

## HISTORICAL BACKGROUND

Although the town of Gulfport, Mississippi cannot claim the antiquity or historical influence of her Gulf Coast neighbors, New Orleans and Mobile, the keels of sailing vessels have plied the waters between Cat Island and Ship Island since Pierre Le Moyne, Sieur d'Iberville's French fleet dropped anchor nearby on February 10, 1699. The relatively deep waters in the lee of what is now known as Ship Island were reported by the French to be a good anchorage. The island was first called Ile de Surgeres, in honor of the Comte de Surgeres, a member of Iberville's expedition. Sometime early in the 1700s the name of the island was changed on French charts to the Ile aux Vaisseaux, or Ship Island (Steckel 1975:6; Mistovich 1987:8).

Ship Island's utility as a safe anchorage was useful for provisioning the French settlement at Biloxi, Iberville's base for his systematic exploration for the mouth of the Mississippi River. It briefly served as the capital of the French colony on the Gulf before it was moved to New Orleans in 1720 (Delaney 1981:30). Ship Island's strategic importance was briefly increased when the French anchorage at Dauphin Island was destroyed by a hurricane in 1717 only to be again eclipsed by the establishment of the port of New Orleans in 1722. Warehouse facilities on the island which had served the thousands of colonists as a

provisioning station were in disuse by 1724 (Mistovich 1987:8).

With the Treaty of Paris of 1763, the Gulfport area, along with the rest of Louisiana Territory east of the Mississippi River, was ceded to Great Britain. During both the Revolutionary War and the War of 1812, Britain stationed ships at the Ship Island anchorage. With the arrival of 30 warships and 30 support vessels at Ship Island on December 10, 1814, the British made use of the strategic position of the island to launch raids against New Orleans.

The strategic importance of Ship Island was not lost on Americans after the conclusion of the war, and it was selected in 1856 as one of the locations for a chain of masonry forts established along the Gulf for coastal defense (Figure 4). The Confederates occupied the unfinished fort at the outbreak of the Civil War, naming it Fort Twiggs after the commanding general at New Orleans. Within three months of Lincoln's proclamation of a blockade of the Confederate coastline, a Federal warship, the Massachusetts besieged the fort but failed to dislodge its garrison. Increased Federal pressure divested the Confederacy of this strategic base in September of 1861 and helped prepare the way for the Union assault on New Orleans. Marines from the Massachusetts eventually captured the fort and renamed it in honor of their ship.

Fort Massachusetts was finally completed in 1871, but technological changes in the warfare rendered it obsolete

even before it was finished. While masonry forts were fine for the style of warfare of the 1850s, the Civil War had brought about the development of the ironclad warship, the exploding cannon shell, and rifled cannon, all of which were capable of reducing a brick fort to rubble. Fort Massachusetts, with its guns mounted en barbette, was a virtual dinosaur even before it was completed, and the government essentially abandoned it by 1880.

Around the turn of the twentieth century, Ship Island enjoyed a brief florescence as the main loading point for lumber which was lightered from the mainland in great quantities. Improvements to the port of Gulfport after 1899 allowed ships to sail directly to the port, eliminating the expensive lightering operation. This eliminated Ship Island once and for all as an important commercial anchorage.

Despite the long history of shipping in the vicinity of Ship Island Pass, there are very few recorded shipwrecks and none recorded before the nineteenth century. The majority of these wrecked on the beach at Ship Island. Other hazards to navigation recorded on Coast Chart No. 90 (Mississippi Sound) dating to 1860 include:

Loggerhead Shoal - one mile south from the neck of Ship Island with 16 1/2 feet of water.

The Middle Ground - 1 mile south of the west end of Ship Island with 17 feet of water.

The Knoll - 1 1/4 mile south of the west end of Ship Island with 17 feet of water.

None of these hazards fall within the project area.

Mistovich (1987) reported 10 wrecks recorded in a

single secondary source, Berman's (1972) Encyclopedia of American Shipwrecks. Reports of an additional seven wrecks were recorded in Collectors of Customs' Reports of Casualty for the ports of New Orleans and Biloxi in the Judicial, Fiscal and Social Branch of the National Archives. These include the following vessels:

The Raffaele Ramano, a wooden schooner sunk in Mississippi Sound on October 2, 1893.

The Dirigo, a 367 ton brig from Galveston bound for Pensacola, foundered on Ship Island Shoal during a gale on October 11, 1881.

The American schooner F. W. Elmer, sank in Mississippi Sound during a hurricane, October 2, 1893, "vessel smashed, crew drowned".

The Bloom, 34 ton schooner, stranded about a mile west of Gulfport. The vessel was 43 years old when she sank while bound for New Orleans with a cargo of charcoal.

The schooner Dixie, 17 tons, sank on the Dog Keys on March 31, 1877 while en route from Pascagoula to New Orleans with a load of charcoal.

The iron-hulled steamship Josephine, built 1867, sank February 8, 1881. Foundered 5 miles SE of the east end of Ship Island while carrying a load of tobacco and cigars from Cedar Key, Florida to New Orleans. The position of the Josephine is recorded on a map drawn by the Corps of Engineers to accompany a report dated September 15, 1881 (Figure 5).

The Schooner Hellen Ellis, built 1867, wrecked on the Dog Keys, February 25, 1882.

An additional wreck was recorded on charts in the collection of the Cartographic Branch of the National Archives:

The schooner George Henry, wrecked on the south beach of the west end of Ship Island. This wreck is recorded on a U.S. Army Corps of Engineers map of Fort Massachusetts drawn in 1868 (RG84-42) (Figure 6).

Despite an exhaustive search of the information on file in the National Archives and Library of Congress relating to historic shipwrecks, no additional shipwreck locations were documented. Neither the wrecks reported by Berman (1972) as cited by Mistovich (1987) nor the wrecks cited above were located anywhere within the potential impact area of the channel construction; most are located well to the east of the channel. No additional historical information has been recovered which would indicate that any historic sites will be affected by the Mobile District's proposed dredging activities.

## METHODOLOGY

### Relocation of Anomaly Targets

GAI was provided with the coordinates of five target locations by the Mobile District which were to serve as the focus of the investigation (Table 1). These coordinates represented points along pre-established survey tracks at which anomalous signals were detected during the Corps' investigation of the area in September 1987 and February/March 1988 (Mobile District 1988a). The coordinates were not intended to represent the actual location of the source of the anomaly but rather the approximate location within the survey track where the source was detected. A particularly massive object could be detected on two or more of the survey tracks. The Corps' survey tracks were 150 feet (45 meters) apart, running parallel to the proposed channel alignment.

GAI's first task involved relocating and buoying the selected coordinates. A Motorola Miniranger radio-positioning system was employed for the task. This system consists of one range console, a receiver and three transponders with 19 dB antennae. The Miniranger operates at a 9 Gigahertz frequency and is quoted as having an absolute measurement accuracy of  $\pm$  one meter on each measured range. The range console was interfaced with a Hewlett-Packard 9816 computer system comprising a CPU with integral CRT display, 9121 dual disk drive, Thinkjet printer and 7575 plotter. The computer system runs proprietary

survey software which takes over control of the Miniranger, firing it directly and taking three ranges simultaneously to derive a least squares position fit in real time. Three ranges are received and a position computed every three to five seconds. The position is then printed out onto paper, logged onto disk and displayed on the CRT. The visual display assists the boat operator in guiding the survey vessel to the position. When the vessel was determined to be over the recorded coordinate, a buoy was dropped to mark the location. Visual relationships with landmarks were noted and a fix was taken with a Loran C navigational computer so that the approximate location of the buoys could be recovered in the event of their accidental loss. Buoy loss turned out to be something of a problem because of the heavy traffic of shrimp boats dragging nets in the area.

Immediately following the buoy drop, a magnetic prospection of the vicinity surrounding each buoyed location was made within a radius of 200 feet from the buoy. Track lines approximately 30 feet (9 meters) apart were run both north to south and east to west in order to ensure complete coverage of the area. The purpose of this prospection was to verify the presence of anomalous magnetic perturbations in the general area of the recorded position and to provide a distance and directional fix in relation to the coordinate buoy for later relocation. This task required one day to install and calibrate the equipment and one day to position and survey the coordinates.

### Search and Excavation

A number of techniques were utilized for locating and exposing the ferrous source of the anomaly targets. The first step in attempting to define the target was to conduct a thorough bottom search of the area. The focal point of the search was a location buoy dropped at the anomaly during a boat survey while towing the magnetometer fish 20 feet (6 meters) off the stern. The most effective search method involved a circle search around the location buoy. Attaching one end of a tape measure to the locational buoy anchor, two divers on SCUBA would then space themselves at 5-foot intervals along the tape and swim in a circle around the area. The circle search was gradually widened at 5-foot (1.5 meter) intervals to encompass an area with a radius of 60 feet (18 meters). While conducting the bottom search, in this area, the divers also used steel probes to locate buried objects. The probes could not penetrate the Pleistocene clay layer lying one to two feet (0.3 to 0.6 meter) beneath the sand. The clay represents a culturally sterile stratum. Any artifacts deposited during the historic period would not penetrate below the clay/sand interface.

The swift currents, sometimes up to three knots, which flow through the Ship Island Pass make the use of SCUBA difficult in this area. As a result, communications-equipped surface-supplied air equipment was sometimes employed. The search was conducted by directing the divers

through the area with voice communication from the surface. The decreased mobility and the length of the umbilical limited the usefulness of this equipment for search operations. SCUBA was much preferred for this task, although additional safety precautions are necessary when working in current.

When no evidence of the target was found either by visual search or probing, the next step involved the refinement of the location of the target area by remote sensing techniques. This was accomplished by utilizing the magnetometer as a gradiometer to determine the point of maximum magnetic deviation. Once the general location of the anomaly was located and buoyed, the diving vessel was anchored with its stern in the vicinity of the marker buoy. A swimmer would then move the magnetometer fish, which was suspended from a float just above the bottom, over the area at the direction of the magnetometer operator until the maximum reading of magnetic deviation was achieved. This position was further refined by a surface-supplied diver who, at the direction of the magnetometer operator on the surface, would pull the mag fish along the bottom until the greatest deviation occurred. The anomaly buoy was then moved to this location, which became the new focal point of search activity.

Following the repositioning of the marker buoy, intensive probing and excavation took place around the marked location. When probing the Pleistocene clay layer

failed to uncover any anomalous features, a trench six feet (1.8 meters) in diameter was excavated to a depth of approximately three feet (1 meter). The bottom of the trench was excavated two feet (0.6 meter) into the Pleistocene clay layer after removal of the sand overburden. Excavation was accomplished by means of a diver-operated hydraulic venturi dredge powered by a two-inch centrifugal water pump.

## RESULTS

Five magnetic targets were identified by the Corps of Engineers for diver investigation. Of the five, only two magnetic anomalies were found to still exist near the originally recorded positions.

A resurvey of targets BB-1-1 and C-1-6 showed the area to be magnetically clean. Both of these anomalies, as identified during the original Corps survey, were of relatively low amplitude, with BB-1-1 recorded as 9 gammas and C-1-6 as 110 gammas. Neither target produced a sidescan signature.

GAI's resurvey of the area employed a Geometrics 866 proton magnetometer. The magnetometer fish was towed at a distance of 50 feet astern of the 42-foot aluminum hull crewboat that served as the project's work boat. Transects were run at 50-foot (15 meter) intervals to cover an area of 90,000 square feet ( $8,360 \text{ m}^2$ ) with the positioning buoy which had been deployed with the aid of the Miniranger at the center of the block. No magnetic anomalies were detected during this operation and it is presumed that whatever had produced the original signature has since been removed from the site, probably by one of the shrimp boats that drag their nets in these waters.

Two point source anomalies were detected in the vicinity of targets A-1-4, A-2-8, and A-3-7. An extremely strong anomaly producing a bipolar signature of 3100 gammas was detected midway between coordinates for A-1-4 and

A-2-8. The configuration of the anomalous signature suggests a single object of high mass.

The second anomaly was recorded closer to the channel at the midpoint on a line between the coordinates for A-2-8 and A-3-7. The GAI resurvey recorded a monopolar signature of short duration with a deviation of 430 gammas. Although the two anomalies were quite close to one another (within 120 feet) they were clearly generated by unrelated, isolated point sources.

The precise location of both anomalies was determined by methods described above. Employing a surface-supplied diver to pull the magnetometer fish along the bottom produced such a strong reading at one point on the anomaly between A-1-4 and A-2-8 that the magnetometer went completely out of phase, deviating as much as 20,000 gammas between readings. The machine reacted in this manner, only when the sensor, located in one very isolated location, indicated that the fish was precisely over the target.

Despite extensive probing and excavation, (often to a depth of three feet in the areas which the magnetometer indicated to be the precise location of the targets) no evidence of the source of the anomaly was found in either instance. One is forced to conclude that the objects lie buried below the Pleistocene clay layer at a depth greater than three feet below the sea floor. It is apparent from the magnetic readings that the objects are of large mass, yet small in area. A similar situation was encountered by

the Principal Investigator in Mobile Harbor in 1983. In that instance, it was determined after six days of excavation that the target source was a core drill casing (Irion and Bond 1984:48). Considering the amount of bottom sampling which has been performed over the past several decades, both by the Corps of Engineers and the oil and gas industry, it is highly likely that this would account for one or both of the anomalies in the study area.

## RECOMMENDATIONS

Although the depth of the two buried objects that produced the anomalous signatures precluded their firm identification, it may be definitely stated that they are not potentially eligible to the National Register of Historic Places (NRHP).

The historical precis assembled by Mistovich (1987) clearly indicates that there are no known structures such as lighthouses or fortifications in propinquity to the project area aside from those currently standing on Ship Island. Therefore, the only conceivable site which could exist in this location which could be potentially eligible to the NRHP is a shipwreck. It is virtually impossible, however, that shipwreck remains would lie below the level of the Pleistocene clay. In a similar situation in a Texas offshore environment, it was found that artifacts of shipwrecks from various periods had migrated through the sand down to the surface of the Pleistocene clay but they did not penetrate the clay to any appreciable depth (Arnold 1982:46). The extensive probing and excavation which was undertaken directly over the anomaly location could not have failed to locate vessel remains under the one- to two-foot thick sand horizon. It must be assumed, then, that the object must have been forcibly intruded into the clay. The most logical explanation for the forcible intrusion of a ferrous object into the clay substrata of the ocean floor is one of mechanical geological prospection.

As previously stated, the two anomaly targets which still exist in the study area have been demonstrated to be single, isolated occurrence unassociated with any site which meets the criteria for inclusion in the National Register of Historic Places. As a result of these investigations, no further work is recommended. It is further recommended that cultural resources clearance to be granted for the proposed channel modification.

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Steckel, James E.

1975 Ship Island and Fort Massachusetts in the History  
of the Mississippi Gulf Coast. Unpublished Masters  
Thesis. University of New Orleans.

Table 1

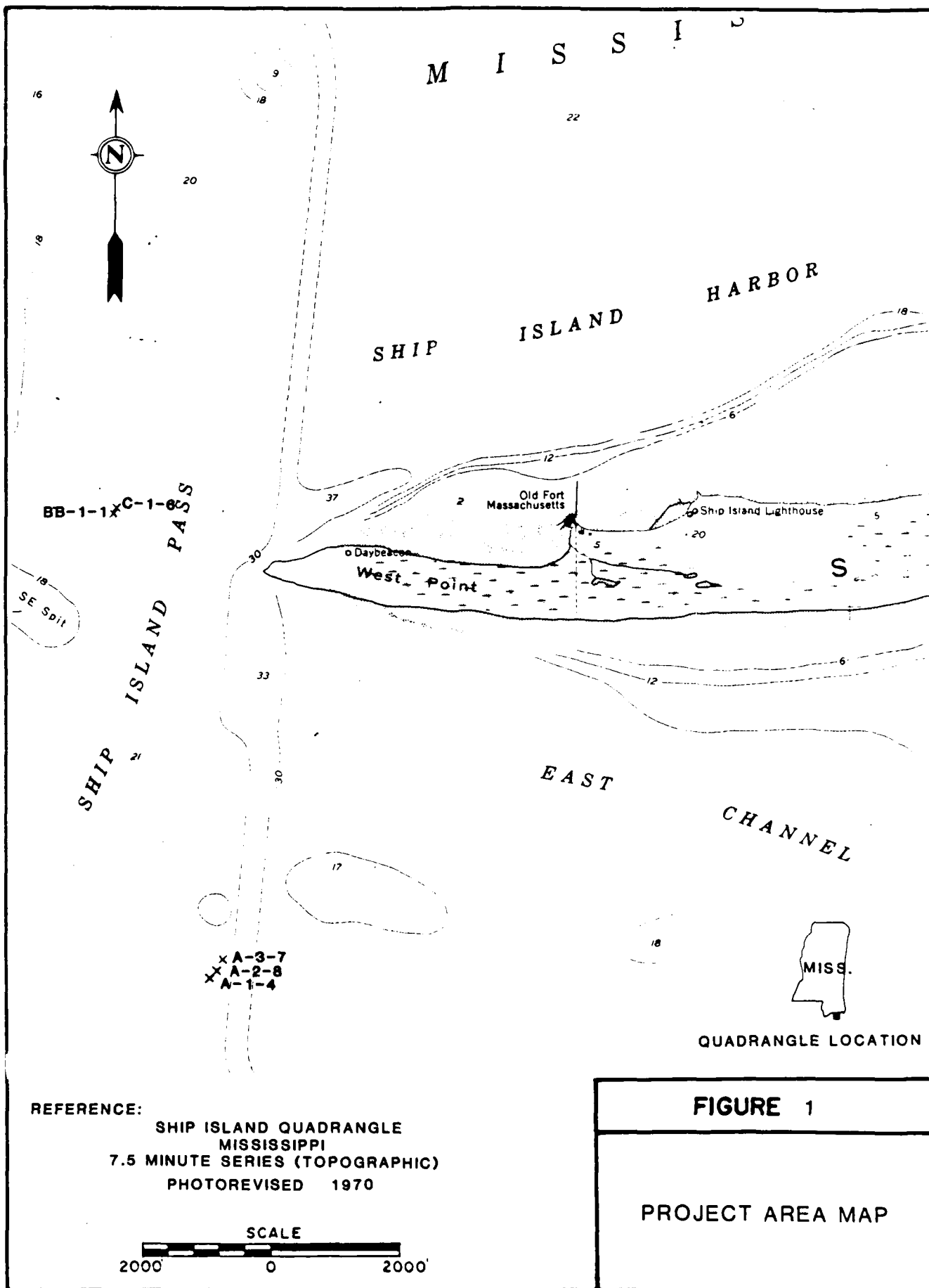
## INVESTIGATED ANOMALIES

<u>Anomaly Number</u>	<u>Gammas (as recorded by COE)</u>
A-1-4	60 - 240 series
A-2-8	700
A-3-7	45
BB-1-1	9
C-1-6	110

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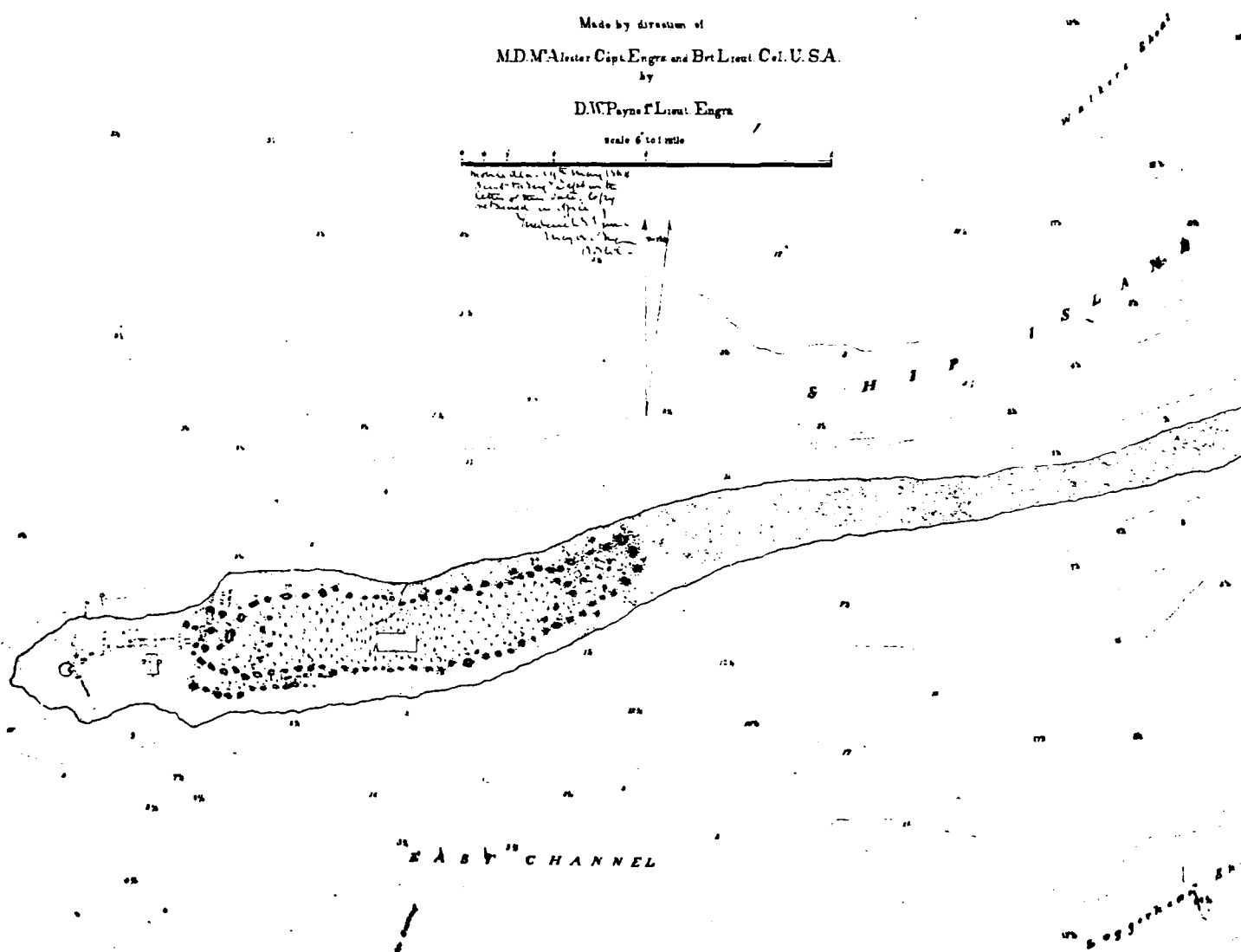
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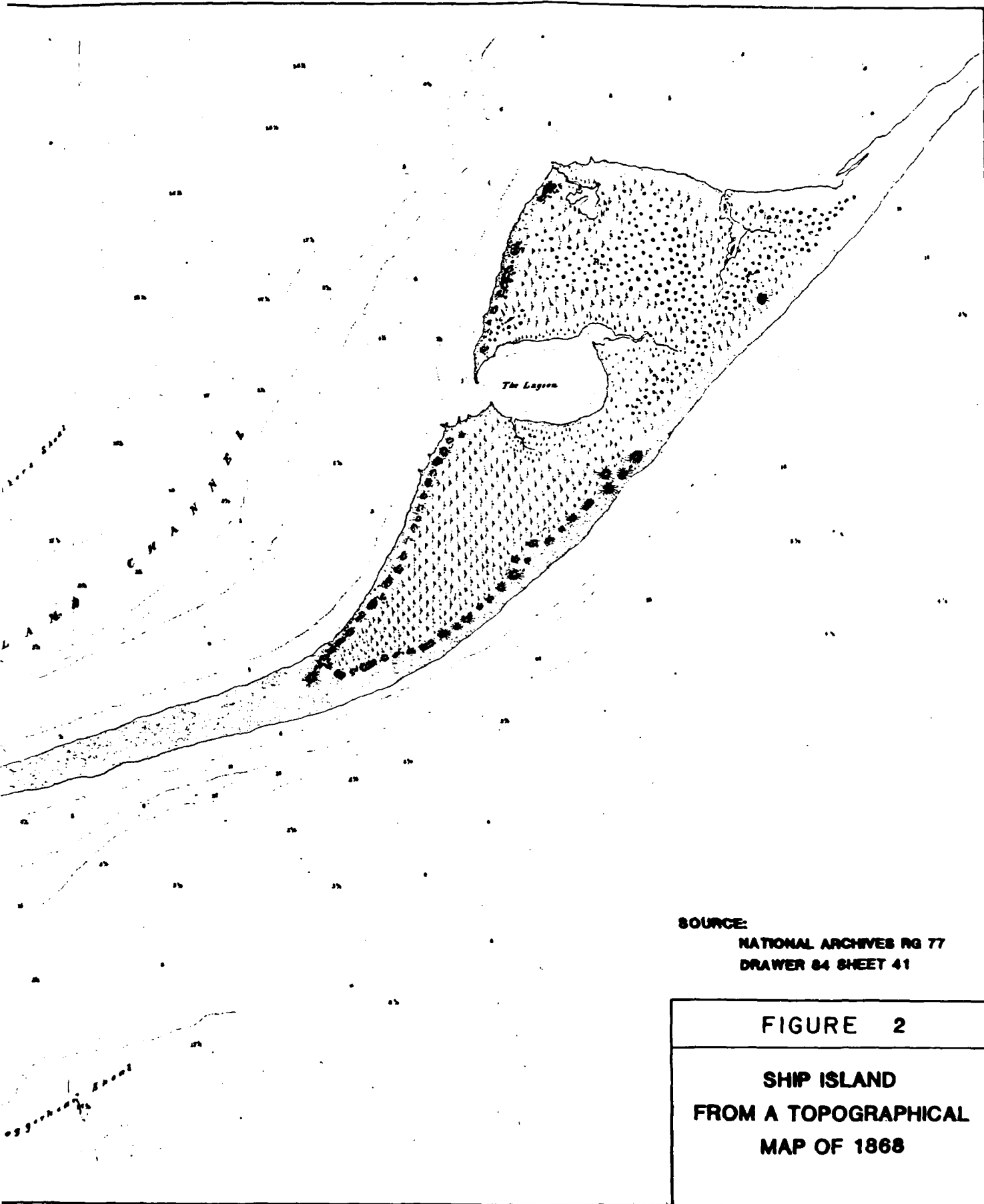
Made by direction of  
MD. McAlester Capt. Engrs and Bvt. Lieut. Col. U.S.A.  
by

D.W. Payne Lt. Engrs

Scale 6" to 1 mile

Reference to map of May 1904  
shows that the light on the  
left of the island is  
not shown in this  
sketch.





SOURCE:  
NATIONAL ARCHIVES RG 77  
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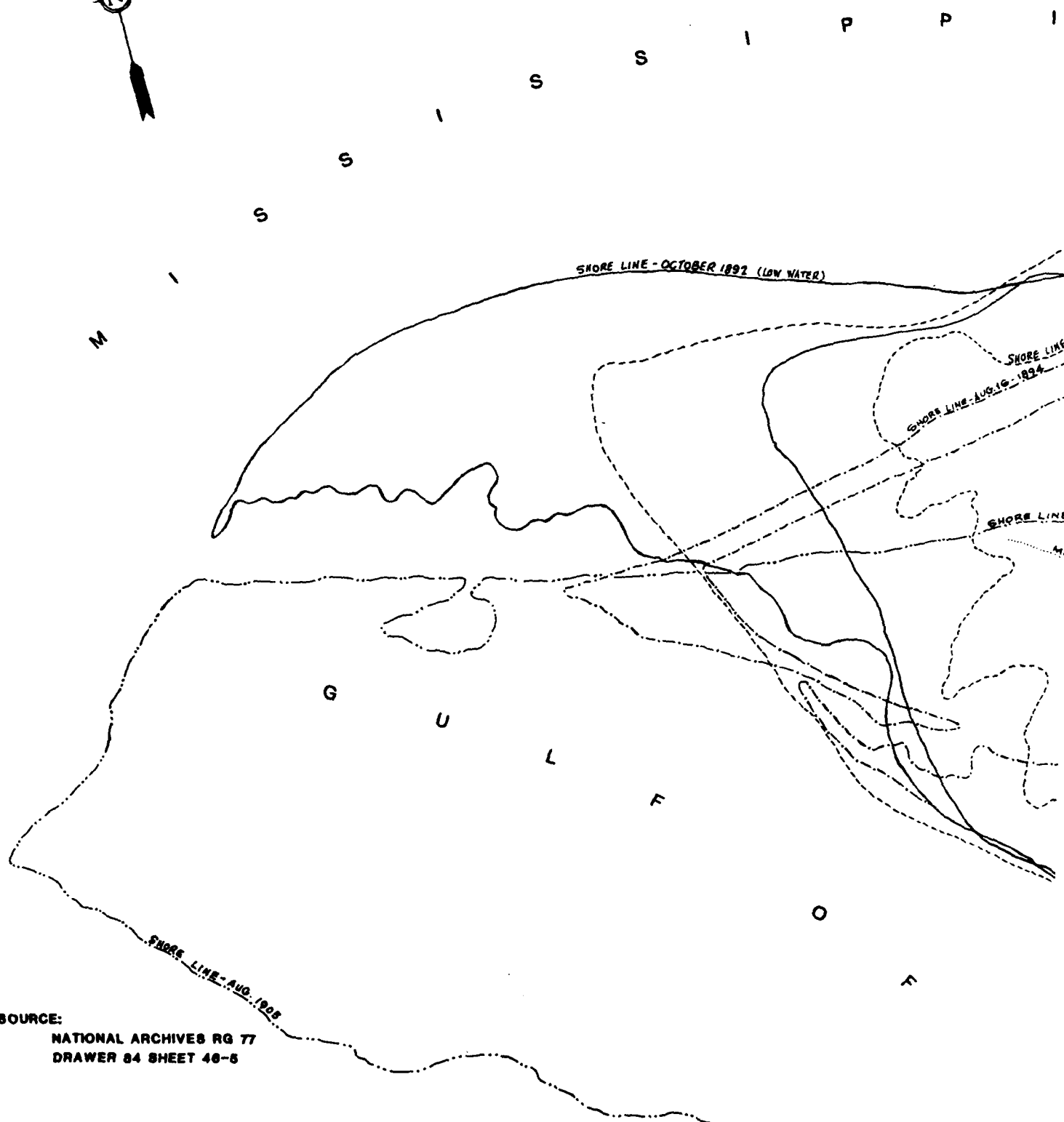
FIGURE 2

SHIP ISLAND  
FROM A TOPOGRAPHICAL  
MAP OF 1868

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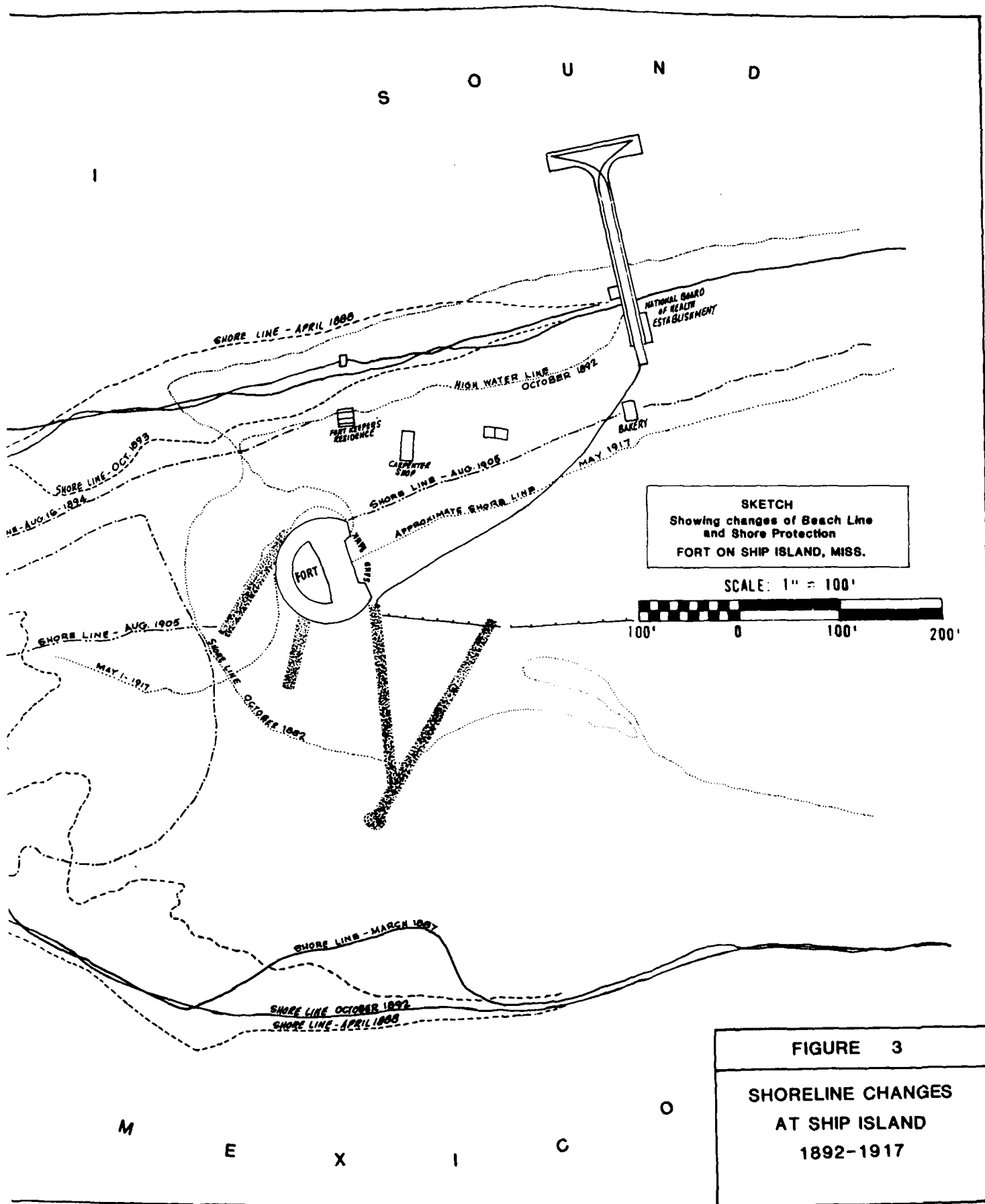
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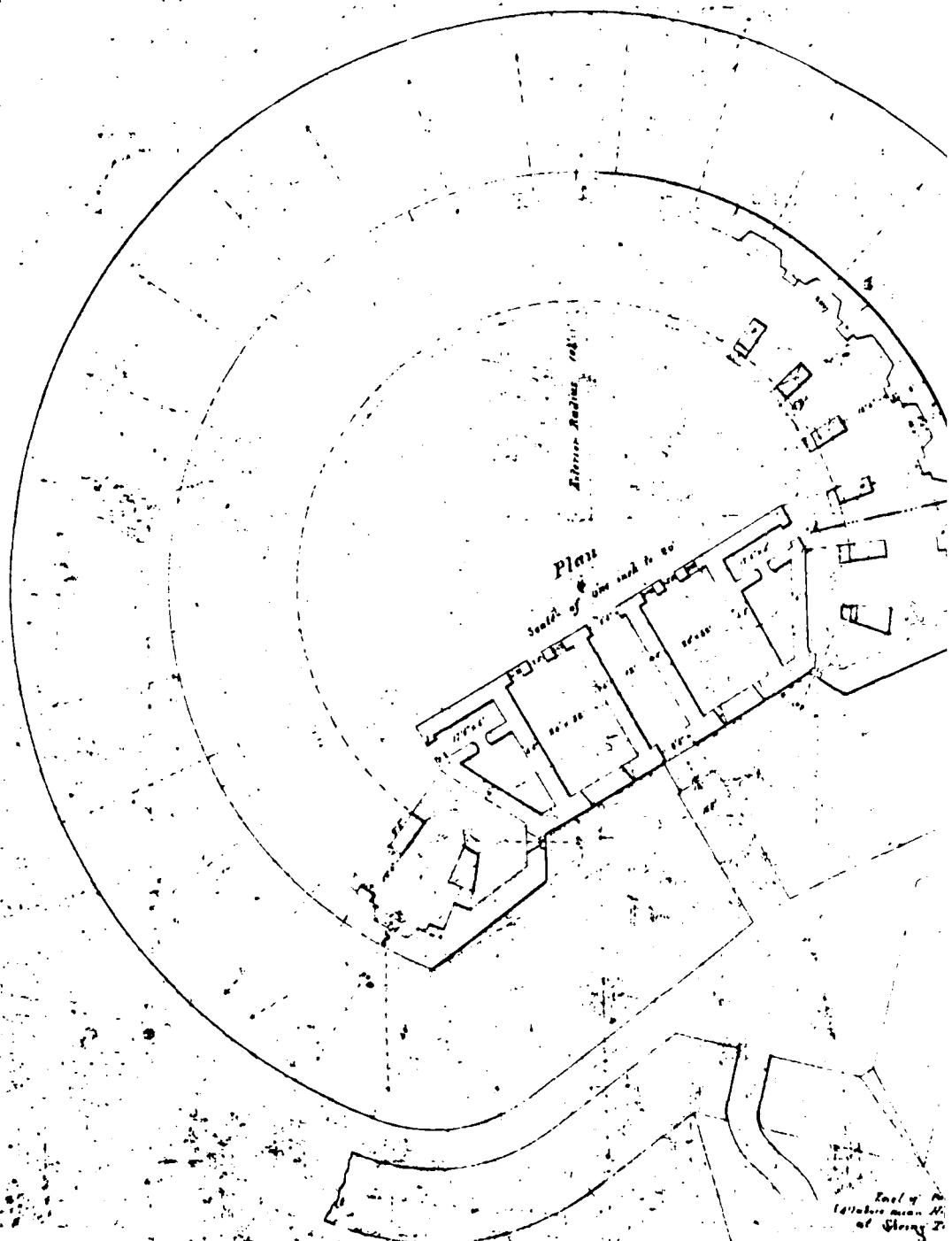


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1892



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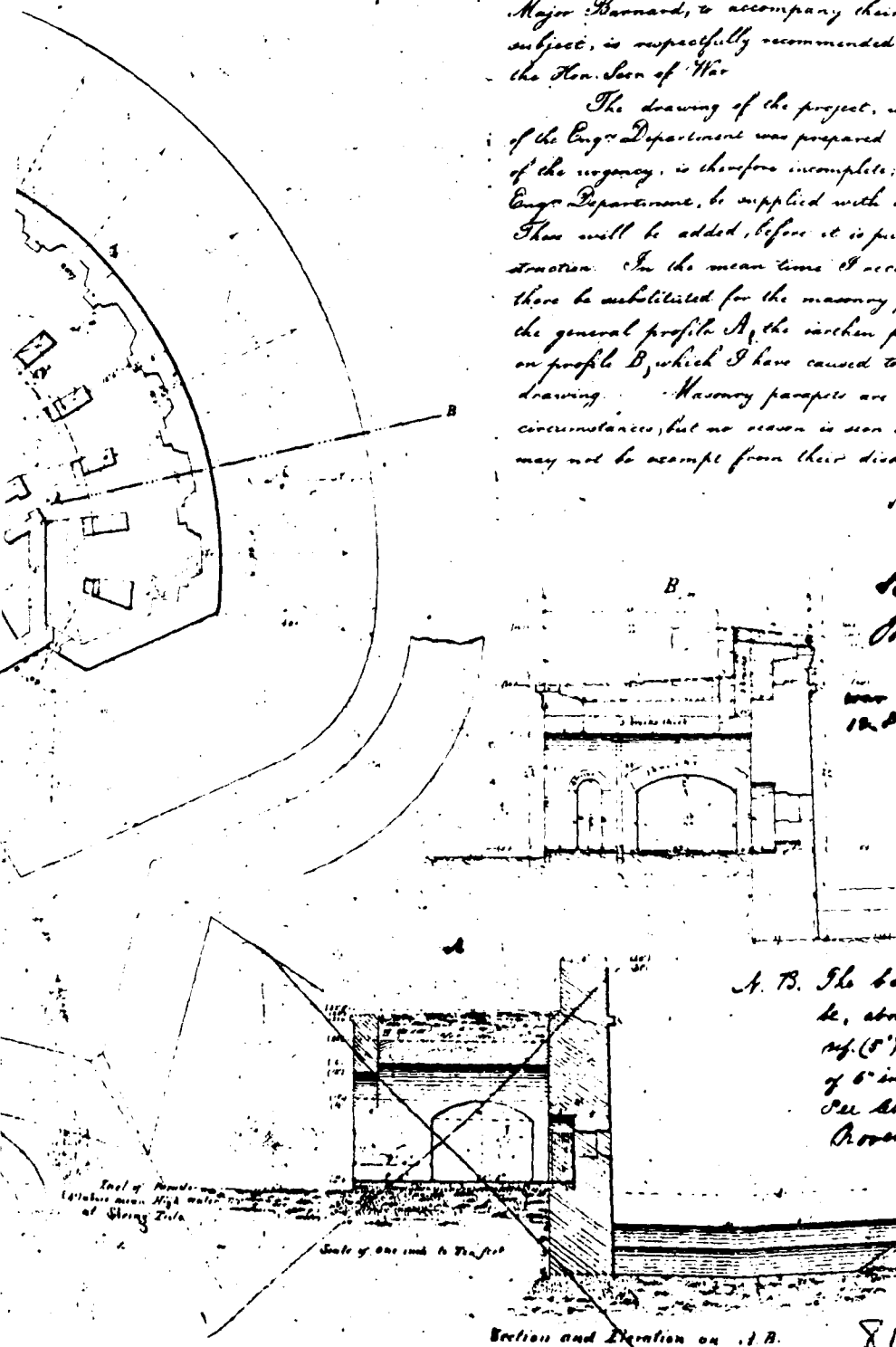
**NATIONAL ARCHIVES FORTIFICATIONS**  
**FILE RG 77 DRAWER 84 SHEET 6**

This project for a fort on the western end of Ship Island (coast of Mississippi) prepared by a special board of Eng<sup>r</sup> consisting of Col Thayer, Lieut De Ruauy & Major Barnard, to accompany their report on the subject, is respectfully recommended to the approval of the Hon. Sec<sup>y</sup> of War.

The drawing of the project, which at the request of the Eng<sup>r</sup> Department was prepared hastily on account of the urgency, is therefore incomplete; but coming in the Eng<sup>r</sup> Department, be supplied with all deficient details. These will be added, before it is put on hand for construction. In the mean time I recommend, that there be substituted for the masonry parapet shown on the general profile A, the earthen parapet indicated on profile B, which I have caused to be added to the drawing. Masonry parapets are obligatory in some circumstances, but no reason is seen why this work may not be exempt from their disadvantages.

J. J. Little Major Genl  
1859

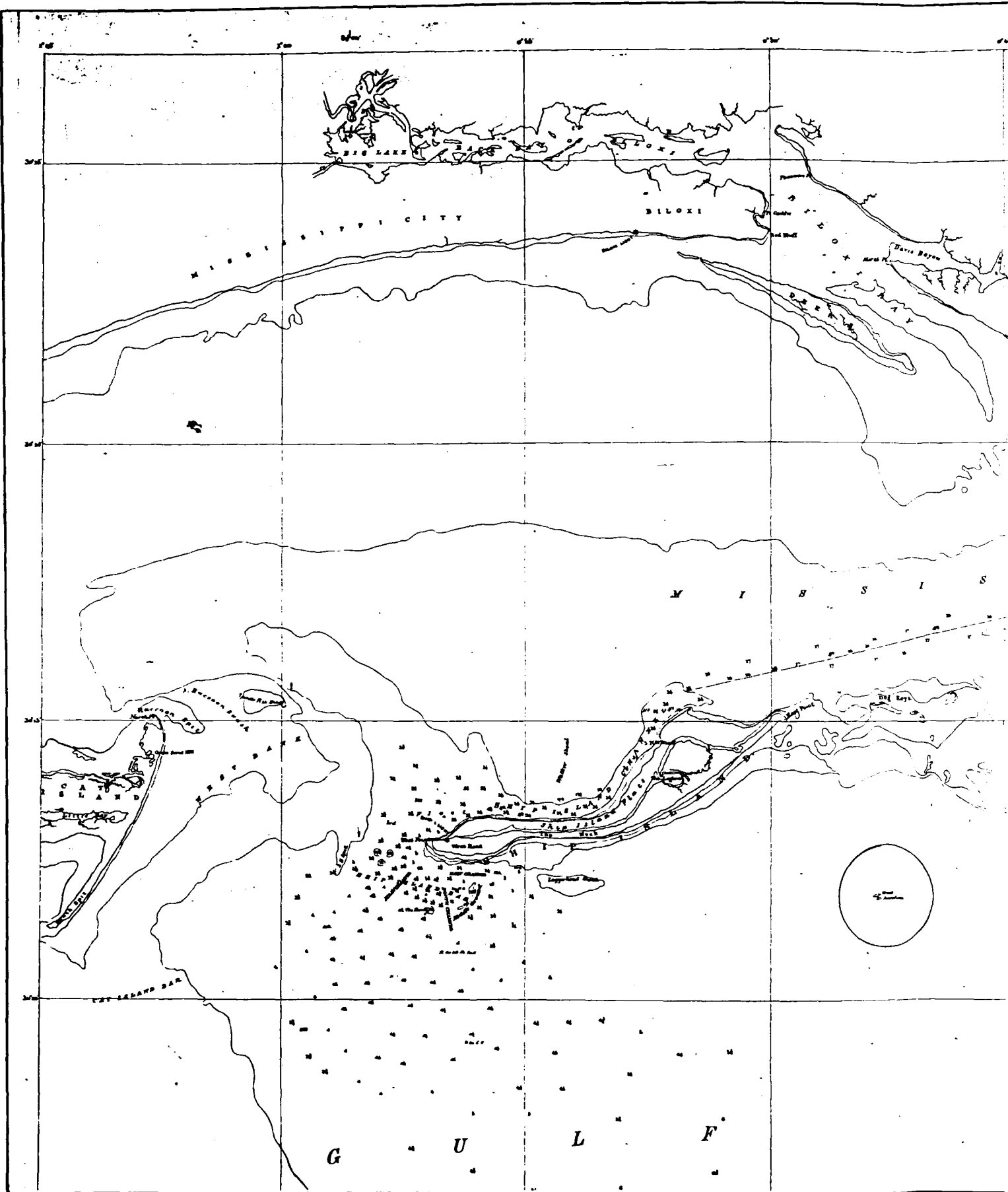
Approved  
Wm B. Ewing  
Secy of War.  
War Dept  
12 Dec. 1859



A. B. The bottom of the scarp is to be, above the casemate floor, say (8')  $\frac{1}{2}$  to the foot, instead of 6' in 20', as here represented. See letter to Chief Engineer of November, 18, 1859.

FIGURE 4

PLANS FOR THE FORT  
AT SHIP ISLAND - 1859

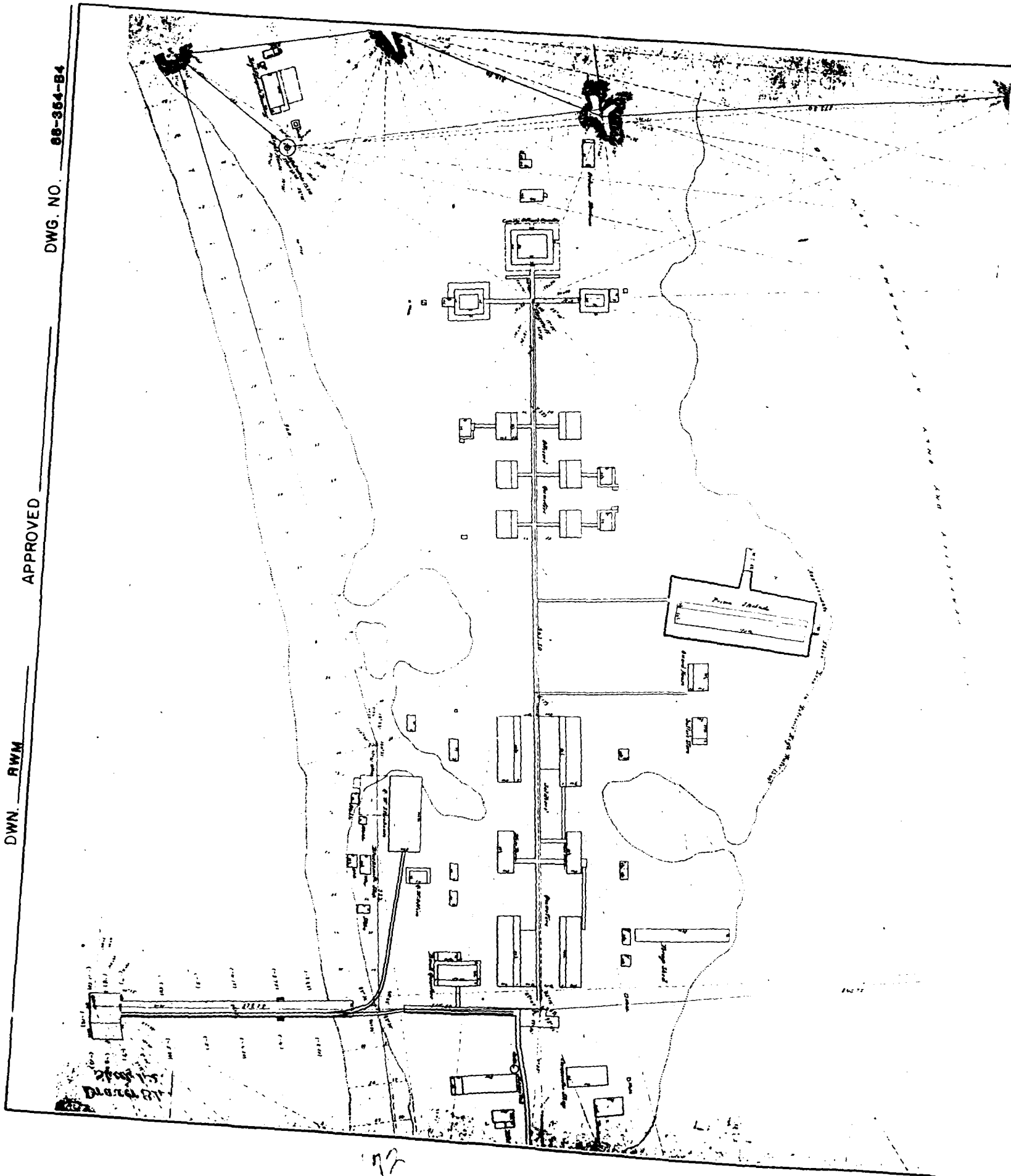


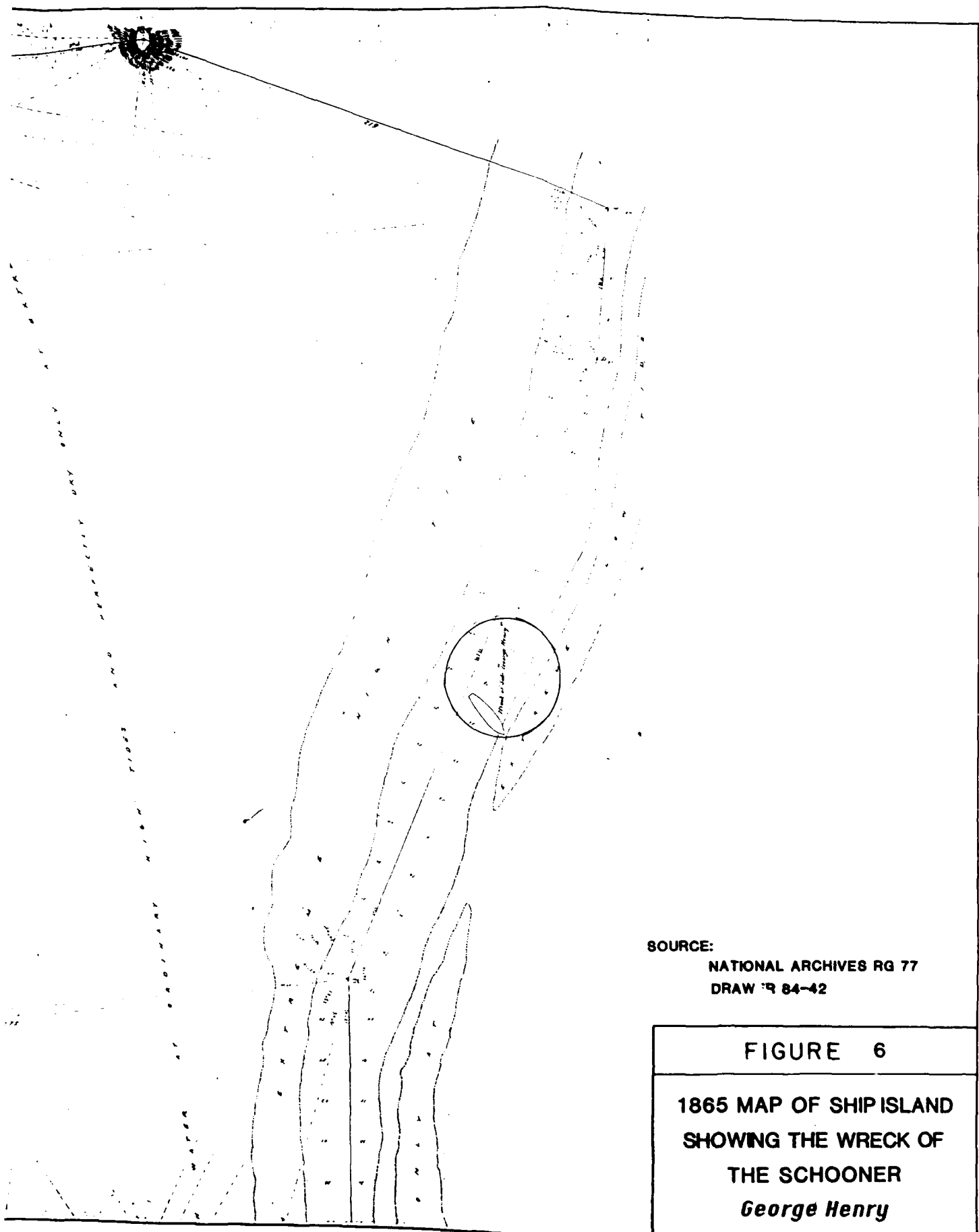


DWN. RWM

APPROVED \_\_\_\_\_

DWG. NO. 88-364-B4





SOURCE:  
NATIONAL ARCHIVES RG 77  
DRAW '9 84-42

FIGURE 6

1865 MAP OF SHIP ISLAND  
SHOWING THE WRECK OF  
THE SCHOONER  
*George Henry*

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APPENDIX A  
DIVING SAFETY PLAN

U.S. ARMY ENGINEER DISTRICT-MOBILE  
P.O. BOX 228/CT-PC  
MOBILE, ALABAMA

DIVING SAFETY PLAN  
FOR  
UNDERWATER ARCHAEOLOGICAL INVESTIGATIONS, SHIP ISLAND PASS,  
GULFPORT HARBOR, MISSISSIPPI

GAI CONSULTANTS, INC.  
570 BEATTY ROAD  
MONROEVILLE, PENNSYLVANIA 15146

PROJECT 88-354

APRIL 1989

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## MISSION

### Purpose

The work will include the underwater cultural resources assessment of anomalies identified during a previous remote sensing prospection of a proposed channel realignment off Ship Island, Gulfport Harbor, Mississippi. The work is expected to include the magnetic prospection and relocation of previously identified anomalies and an underwater physical examination of these anomalies through underwater archaeological excavation and probing.

### Location

The investigation is to take place in the vicinity of new channel construction in the Gulf of Mexico and Mississippi Sound in the vicinity of Ship Island, Mississippi. Water depth is approximately 20 feet.

### Dates and Times

- (A) Date of project: Fieldwork proposed to be completed 18 November 1988.
- (B) Times: Hours of 30 minutes after civil sunrise to 30 minutes before civil sunset.

## OPERATING PROCEDURES

### General Safety Procedures

The Dive Officer will also be in charge of general project safety.

- o All facilities, equipment, vessels and safety equipment will be inspected by the Dive Officer weekly.
- o Training sessions, seminars or procedural review may be requested of the Dive Officer at any time. There will be periodic review of objectives and goals of Project to update all participants. Regular meetings regarding safety and operations will be held weekly.
- o Training sessions, seminars of procedural review may be requested of the Dive Officer at any time. There will be periodic review of objectives and goals of Project to update all participants. Regular meetings regarding safety and operations will be held weekly.
- o All personnel will be responsible for knowing safety regulations herein stated and otherwise specified by the Dive Officer.
- o It is the responsibility of each project participant or visitor to conduct all activities in a safe manner.
- o All accidents or injuries will be reported to the Dive Officer immediately, regardless of how slight. A report of injury form will be completed.
- o All personnel will be familiar with the location of safety equipment, fire extinguisher and procedures.
- o Standard operations procedures are established for all machinery. Operators will familiarize themselves with these procedures before operation.

- o A maintenance and operation log will be maintained for all operating machinery.
- o Evacuation route to emergency medical facilities will be established for all areas of the bay and all persons will know these routes. There will be sufficient gasoline maintained in all vehicles for emergency use. There will be a vehicle available for emergency use at all times during diving operations.
- o Each member of the project is expected to be proficient at cardio-pulmonary resuscitation and basic first aid procedures as well as Project specific emergency situations as deemed necessary by the Dive Officer. Training will be given prior to and during the project for those not proficient and those requiring review.
- o Project personnel will be issued written material on safety and are responsible for knowing its contents, e.g., Coast Guard boating safety publications, American National Red Cross First Aid Manual, and Cardio-Pulmonary Resuscitation Manual.
- o Non-slip footwear will be worn at all times while on vessels. Life jackets are not required in enclosed areas or by divers in wetsuits. Sufficient life jackets will be on board for each person.
- o A fire extinguisher will be aboard each vessel, in each vehicle and in the immediate vicinity of any motor or fuel storage area. These will be checked weekly.
- o All cans of fuel will meet prescribed OSHA standards and will not be stored aboard any vessel except in transit and then only when necessary.

### Diving

All divers will adhere to this standard and all revisions that develop during the Project.

- o All divers will be required to demonstrate proficiency in pre- and post-dive procedures, water skills and theory of diving.
- o Each diving participant must show at least basic certification and should present the Dive Officer with their personal current dive log. Visiting divers from governmental agencies will have appropriate current diver certification. All divers will be cleared through the project officer on project specific procedures.
- o All divers will be cleared by the Dive Officer or his designate in his absence.
- o There will be no decompression dives done on this project. Divers working hard in cold water will monitor their time and not come within 15 minutes of any no-decompression time limit for the working depth.
- o A stand-by diver will be present whenever dive operations are being conducted.
- o Planning sessions will precede each dive. This session will include an assessment of safety aspects, potential hazards, task to be undertaken, emergency procedures and any modification to operating procedures necessary for specific operation.
- o All dives will be logged and written comments are required of the diver immediately upon completion of the dive.
- o A diver will report any injury or abnormal sensation, regardless of how slight, to the Dive Officer.

- o Colds, upper sinus infections, respiratory infections, and ear infections are contra-indicated in diving. It is every project participants' responsibility to maintain good health during the project.
- o Medication for ears. Divers will use the medicated solution which is supplied in the ears following each dive.
- o The Dive Officer will be informed of the ingestion of any medication.
- o A diver shall remain awake for at least one hour after a dive.
- o There will be no flying done for a minimum of 12 hours following a dive.
- o It is the responsibility of the divers to disqualify themselves from a dive or terminate a dive at any time it is felt that the dive should not be made or continued, or even if there is a reasonable doubt. Each diver is expected to assess their own physical and mental condition before each dive. If you are not totally confident that you can handle the assigned task or any emergency situation that should arise, you are expected to opt out of a dive. An explanation is not necessary.
- o An "ALPHA" diving flag will be displayed at all times during diving operations.
- o Periodic evacuation and emergency drills will be carried out on each diving vessel to standardize and familiarize all personnel with these procedures.
- o All persons will be proficient in radio operation and follow established communication procedures should emergency evacuation be necessary.
- o Air supplied to the diver shall not contain:

1. A level of carbon monoxide in excess of 20 ppm.
  2. A level of carbon dioxide in excess of 1000 ppm.
  3. A level of oil mist in excess of 5 milligrams per cubic meter.
  4. Detectable moisture, dirt, particulates or odor.
- o Diving shall not take place within eight hours of the consumption of alcohol, two hours of consumption of a heavy meal or on an empty stomach.
  - o A diver who has performed arduous work in a one-hour period preceding a dive shall not be assigned stand-by diver duties for dives over 12 feet.

#### Equipment Selections and Use

Scuba Diving. All Scuba diving will be done in buddy teams or be line tended. In conditions of current exceeding one knot Scuba divers will be line tended from the surface with a rope (so that it may be cut if necessary) or have a quick release mechanism.

In low visibility water a surface float attached to divers may be required.

#### Equipment

- o All equipment will be inspected by the Dive Officer weekly.
- o All personal gear will be marked.
- o Prior to each dive, surface tender (if using line to surface) or buddy will check diver's equipment for proper location and function.
- o All demand regulators will be inspected at least every six months and be of proper construction to operate at maximum cylinder pressure.

- o All divers will have a submersible pressure gauge, operational and affixed to breathing supply. This gauge will be within  $\pm 5$  percent accuracy and equipped with a burst disc.
- o All hoses will be inspected prior to each dive for signs of cuts or abrasions. This examination will take place while hose is under pressure so that leaks and bulges can be detected.
- o All divers will carry sharp knives.
- o Divers will carry reserve air supply as a functioning J type reserve valve or extra tank independent of main air supply.
- o All tanks will meet Department of Transportation requirements as well as comply with applicable provisions of 29 CFR, Sections 1910.166-171.
- o Tanks will be inspected at least every 6 months and be under current hydrostatic test date.
- o Tanks will be protected from heat, blows, and falling at all times.
- o A buoyancy compensator (B.C.) capable of at least 30 pounds lift at the surface will be worn at all times. The B.C. will have provisions to be activated orally and mechanically by compressed gas. All units will have an over pressure exhaust valve.
- o All harnesses and weight belts shall have quick release buckles.
- o All compressed air used to fill tank cylinders will have a current (1 year) analysis and meet specifications as stated. Air compressors will be maintained according to manufacturer's specifications. If air is purchased from a commercial source, these records will be checked prior to filling tanks.

- o The Scuba tank pressure will be recorded on the log sheet prior to each dive.

Surface Supplied.

- o Air will be supplied from 235 cu ft air cylinders
- o All divers will carry an independent reserve bail out air supply.
- o Surface supplied divers shall be in voice communication with surface tender.

MASKS:

1. Will be maintained according to manufacturer's specification and only approved spare parts will be used for replacement. No modifications will take place.
2. Will be equipped with a non-return valve and the valve will be checked by the tender prior to each dive.
3. Will have reliable oral communications between the tender and the diver.

HOSES:

1. Will have bursting pressure at least four times greater than operating pressure of at least 80 psi over bottom (ambient)
2. Will be of sufficient size for flow rates of 4.5 cubic feet per minute.
3. Will be kink resistant, marked in 10-foot lengths from the diver end and be equipped with proper corrosion resistant fittings.
4. Will be coiled or figure-eighted to prevent twists at all times when not in actual use. The hose ends will be capped at all times when not in use. Each hose will be inspected prior to each dive.

5. All compressor volume tank and hose connectors will be secured to prevent accidental disconnection.
6. Divers will wear harnesses with quick release attachment to safety line. Safety line will have a breaking strength in excess of 500 pounds.
  - o The quick release will be attached to the harness in a manner such that the strain distributes over the diver's body.
  - o The tender will help the diver off and on all equipment, adjust and secure it. The tender will check and insure that the diver is properly rigged and adjusted immediately before the diver enters the water. The diver will not enter the water until clearance from tender is given. The diver will check all equipment for proper functions, immediately upon submerging. The tender will monitor and periodically report bottom time to the diver.
  - o Tender should allow two to three feet of slack in the diver's line, but should be able to feel the diver from time to time. Signals cannot be felt in a slack line. The diver's hose will be held in hand with proper tension at all times.
  - o While it is the tender's duty to have equipment checked out and prepared for each dive, each diver will check all equipment used on the dive to insure proper function and location prior to entering the water.
  - o All signals, whether hand or line, are active and are to be returned with one exception of a 4-4-4 line signal for emergency haul up. All persons involved with surface supplied equipment either as a tender or diver will demonstrate knowledge of and

proficiency in the standard line pull signals to satisfaction of Dive Officer.

## ACTIVITY HAZARD ANALYSIS

Numerous potential hazards exist for humans working within the marine environment. Potential hazards are identified below with the appropriate response indicated.

### Dangerous Marine Organisms

Potentially dangerous marine organisms which inhabit the Gulf include jellyfish, stingrays and sharks. The first response to these organisms will be avoidance. In the event of an injury, appropriate first aid will be applied and, if severe, the patient evacuated to the nearest medical facility.

### Diver Fouling

Diver fouling can occur from the many obstructions, lost fishing nets and lines and cable which are found on the ocean floor, and, in fact, form the object of search in many cases. Procedures to be followed in the event of a fouled diver are as followed:

Scuba Diver. Scuba Diving will always to conducted using the buddy systems. The diver's buddy will assist in freeing his tangled partner.

Surface-Supplied Diver. Notify tender via communications or line signal if necessary. Describe the situation to the tender. The diver should attempt to follow the hose back while coiling the slack. If the diver cannot free himself, he should wait for a second diver. Struggling and panic are the chief potential dangers.

Emergency Procedures in the event of losing communication with a surface-supplied diver:

1. Effect line pull communications immediately. Notify standby diver.
2. Four pulls will be given by the tender to the diver. Diver will answer signal and immediately ascend.
3. If tender receives no answer to four-pull signal, slack should be taken up and signal repeated. Standby diver will be notified.
4. If there is tension on the line but diver provides no response, he is presumed to fouled and possibly unconscious. Standby diver will be dispatched and preparations made for resuscitation and evacuation.

#### Small Boat Traffic

A potential hazard exists from the small boats which operate in the area. The following precautions will be taken to avoid this potential hazard:

1. The international ALPHA flag indicating a stationery vessel along with the red-with-diagonal white stripe diver-down flag will be prominently flown.
2. A large, international-orange buoy will be set out astern of the dive vessel to warn boats away from the area.
3. If a potential hazard is recognized from an infringing vessel, divers will be notified to return to the dive boat and assistance requested from the U.S. Coast Guard via marine-band radio.

#### Ship Traffic

A constant watch will be maintained for ship traffic. Divers will be ordered to return to the vessel, and crew will retire to a safe distance until the danger has passed.

Decompression Sickness and Gas Embolisms

No decompression diving shall be carried out under this contract. U.S. Navy Standard No-Decompression Limits will be adhered to with an additional margin for safety accomplished by adding ten feet to the actual depth when figuring no decompression limits and repetitive groups.

## ACCIDENT MANAGEMENT PLAN

After the victim of an accident has been removed from the water, a reassessment of the situation will be made immediately. An unconscious diver should be suspected of gas embolism and so treated. Outside help will be summoned immediately.

Summoning Aid in Emergencies

In the event of a serious accident, the U.S. Coast Guard Search and Rescue(SAR) Unit located in will be requested to provide immediate assistance.

- o The Coast Guard will be contacted via marine band radio channels 16 or 22. A crew member will be stationed by the radio throughout the emergency. The telephone number for the U.S.C.G. Station at Gulfport is (601) 863-5818.
- o When contact is made, the caller will declare that the situation is an emergency and state the nature of the emergency.
- o Other information provided to the Coast Guard will include:
  - latitude and longitude of nearest anomaly,
  - prominent land marks,
  - environmental conditions,
  - status of victim,
  - unusual circumstances and number of victims identified.
- o The nearest recompression chamber to the dive site is located at Spring Hills Memorial Hospital, 3719 Dauphin Street, Mobile, Alabama 36608.